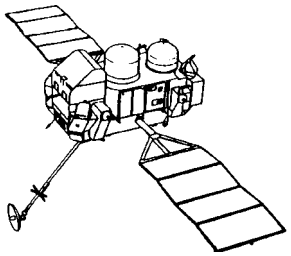
GRO

Gamma Ray Observatory

Spacecraft Sketch	Mission Objective
	The objective of the Gamma Ray Observatory (GRO) is to provide a first opportunity for comprehensive observations covering over five decades of energy from 0.1 MeV to 30,000 MeV. Long exposures by extremely large and heavy instruments above the absorbing atmosphere are utilized to achieve this objective. The GRO is flown in a low-inclination, nearearth circular orbit to minimize the background effects caused by cosmic rays and particles trapped in the Earth's magnetosphere. Some of the physical processes that can be uniquely examined using gamma rays are: 1) nuclear interations of energetic nuclei; 2) electromagnetic processes; 3) processes that produce gamma ray lines; and (4) matter/antimatter annihilation.

TYPE OF MISSION	PROGRAM OFFICE	PROJECT LEAD CENTER	MANAGEMENT APPROACH	S/C CONTRACTOR	I&T CONTRACTOR
Astrophysics	SPACE SCIENCE & APPLICATIONS	GSFC	HYBRID	TWR	TWR

Payload Description
The GRO flight segment or payload observatory consists of four scientific instruments and a basic spacecraft bus with standard support systems and a propulsion system. The four instruments include Oriented Scintillation Spectrometer Experiment (OSSE), Imaging Compton Telescope (COMPTEL), Energetic Gamma-Ray Experiment Telescope (EGRET) and Burst and Transient Source Experiment (BATSE). The GRO payload is three-axis stabilized and capable of pointing to any celestial target for long periods of time (days to weeks). The GRO spacecraft main subsystems are redundant for increased reliability during the mission. Data from the GRO instruments are transmitted to the ground via the Tracking and Data Relay Satellite System (TDRSS) in telemetry data packets produced by the on-board spacecraft data-handling software. After separation in a ground-based packet processor, these data packets go to the respective Principal Investigators (PI's) for analysis.

INSTRUMENT NAME	ACRONYM	PI AFFILIATION	PRINCIPAL INVESTIGATOR	I&T CONTRACTOR
BURST & TRANSIENT SOURCE EXPERIMENT	BATSE	MSFC	G. J. FISHMAN	MSFC
ENERGETIC GAMMA-RAY EXPERIMENT TELESCOPE	EGRET	GSFC	C. E. FICHTEL	GSFC
IMAGING COMPTON TELESCOPE	COMPTEL	MAX PLANCK	V. SCHOENFELDER	UNIV NEW HAMPSHIRE
ORIENTED SCINTILLATION SPECTROMETER EXPERIMENT	OSSE	NRL	J. D. KURFESS	NRL

Instrument Descriptions
The GRO Burst and Transient Source Experiment (BATSE), Data Point 670, consists of eight wide field detector modules arranged on the spacecraft to permit maximum unobstructed viewing of the sky. The main detector within each module is a disk of sodium iodide scintillation crystal, 20 inches in diameter and one-half inch thick. Each module has an anticoincidence shield on the front side to reduce the effects of charged particles and a thin lead shield around the outside of the light housing to reduce the amount of scattered radiation entering the back side.The BATSE consists of eight wide-field detector modules arranged on the GRO spacecraft to permit maximum unobstructed viewing of the sky. Each detector module contains a large-area detector, optimized for high sensitivity and directional response, and a spectroscopy detector, optimized for broad energy coverage and good energy resolution.
The GRO Energetic Gamma-Ray Experiment Telescope (EGRET), Data Point 693, consists of two levels of a four-by-four scintillator array with selected elements of each array in a time-of-flight coincidence. The upper spark assembly consists of 28 spark chamber modules interleaved with 27 0.02 radiation length tantalum plates in which a gamma ray may convert into an electron pair and in which the initial direction of the electrons may be determined. The lower spark chamber assembly: 1) allows electron trajectories to be followed; 2) provides further information on the division of energy between electrons and 3) permits viewing separation of the electron pair for very high energy gamma rays. The gamma ray energy will be determined in one of eight Nal(TI) scintillator crystals below the lower time-of-flight scintillator plane.
The GRO Imaging Compton Telescope (COMPTEL), Data Point 671, consists of two detectors separated by a distance of 1. 5 meters. Each detector is entirely surrounded by a thin anticoincidence shield of plastic scintillator which rejects charged particles. Between the detectors are two small plastic scintillation detectors which are used as gamma ray calibration sources. In the upper detector, a liquid scintillator is used. In the lower detector, plat (T1) crystals are used. In the upper detector a gamma ray is first Compton-scattered and then the scattered gamma ray is absorbed in the lower detector. The locations and energy losses of both interactions are measured to determine the energy and the angular resolution.
The GRO Oriented Scintillation Spectrometer Experiment (OSSE), Data Point 669, consists of four identical phoswich detector systems. Each of the detectors is mounted in a single axis orientation control system which provides offset pointing over a range of 180 degrees. The detectors are generally operated in co-axial pairs. The primary element of each detector system is the Nal portion of a 33 cm diameter phoswich. Pulse-shape discrimination is used to distinguish energy depositions in the Nal primary element from those in the Csl portion of the phoswich. An annular shield assembly, together with the Csl portion of the phoswich, forms the active anticoincidence shield for background rejection.n.

Launch
4/5/91